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bio-chemical reaction, bio-electro-chemical reaction, reaction speed, reaction energy, speed of reaction, oxygen concentration, oxygen consumption rate, ionic strength, catalytic behavior, chemical additives to trigger enhanced signal response, bio-chemical additives to trigger enhanced signal response, biological additives to trigger enhanced signal response, chemicals to enhance detection sensitivity, bio-chemicals to enhance detection sensitivity, biological additives to enhance detection sensitivity, or bonding strength; density, shape, volume, or surface area; surface shape, surface area, surface charge, surface biological property, surface chemical property, pH, electrolyte, ionic strength, resistivity, cell concentration, or biological, electrical, physical or chemical property of solution; frequency, speed of acoustic waves, acoustic frequency and intensity spectrum distribution, acoustic intensity, acoustical absorption, or acoustical resonance; internal pressure, hardness, flow rate, viscosity, fluid mechanical properties, shear strength, elongation strength, fracture stress, adhesion, mechanical resonance frequency, elasticity, plasticity, or compressibility.

33. The apparatus of claim 30, wherein the shapes and sizes of different sections of the channel can be the same or different.

34. The apparatus of claim 30, wherein the width of the channel ranges from about 1 nm to about 1 mm.

35. The apparatus of claim 1, wherein the interior wall of the channel defines a circular, oval, polygon, or rectangular space.

36. The apparatus of claim 35, wherein the channel is a circular carbon nano-tube.

37. The apparatus of claim 36, wherein the carbon nano-tube has a diameter from about 0.5 nm to about 1 micron and a length from about 5.0 nm to about 10 mm.

38. The apparatus of claim 30, wherein the interior wall of the channel has at least one concave groove that may be in the same section as a probing or detecting micro-device.

39. The apparatus of claim 38, wherein the concave groove is a depth of from about 10 nm to about 1 mm.

40. The apparatus of claim 30, wherein a disturbing fluid is injected into the channel, either before or after the biological

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subject passes a probing micro-device, to aid the traveling or separation of the biological subject inside the channel.

41. The apparatus of claim 40, wherein the distribution fluid is injected into the channel through a distribution fluid channel connected to an opening in the channel wall.

42. The apparatus of claim 30, wherein the apparatus is for detecting circulating tumor cells in two or more biological subjects, and the channel comprises a device located therein for separating or dividing the biological subjects based on different levels of a same property of the biological subjects.

43. The apparatus of claim 42, wherein the separating or dividing device is a slit and separates or divides biological subjects based on their surface charges.

44. The apparatus of claim 30, further comprising a filtering device configured for removing irrelevant objects from the biological subject for detection.

45. The apparatus of claim 4, further comprising a channel, a pre-processing unit, a re-charging unit, a detection unit, a data storage unit, a data analysis unit, a central control unit, a biological sample recirculation unit, a waste disposal unit, a global positioning system, a motion device, a signal transmitter, a signal receiver, a sensor, a logic processing unit, an application specific chip, a micro-electro-mechanical device, a multifunctional device, or a micro-instrument to perform surgery, drug delivery, cleaning, or medical function.

46. The apparatus of claim 45, wherein the apparatus is integrated on a single device or a board.

47. The apparatus of claim 45, wherein the pre-processing unit comprises a filtration unit, a nutrient and respiring gas recharging unit, a constant pressure delivery unit, or a sample disturbing unit.

48. The apparatus of claim 1, wherein the tumor cells are from prostate cancer, lung cancer, colon cancer, breast cancer, brain cancer, cervical cancer, Hodgkin's lymphoma, non-Hodgkin's lymphoma, kidney cancer, leukemia, liver cancer, ovarian cancer, skin cancer, testicular cancer, thyroid cancer, pancreatic cancer, endometrial cancer, esophageal cancer, or uterine cancer.

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